GIS within an all-relational framework

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GIS-T
April 9-11, 2001

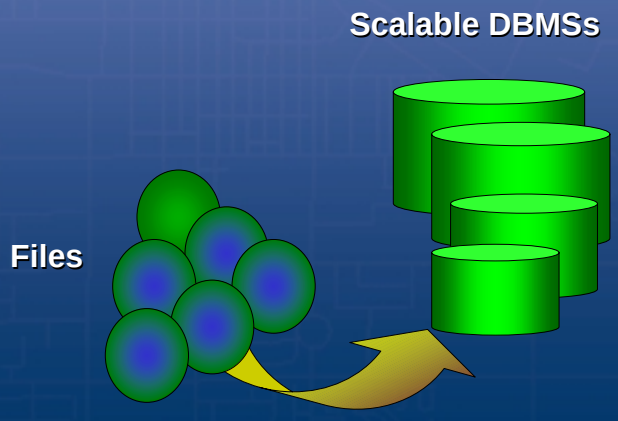
Back in the day…

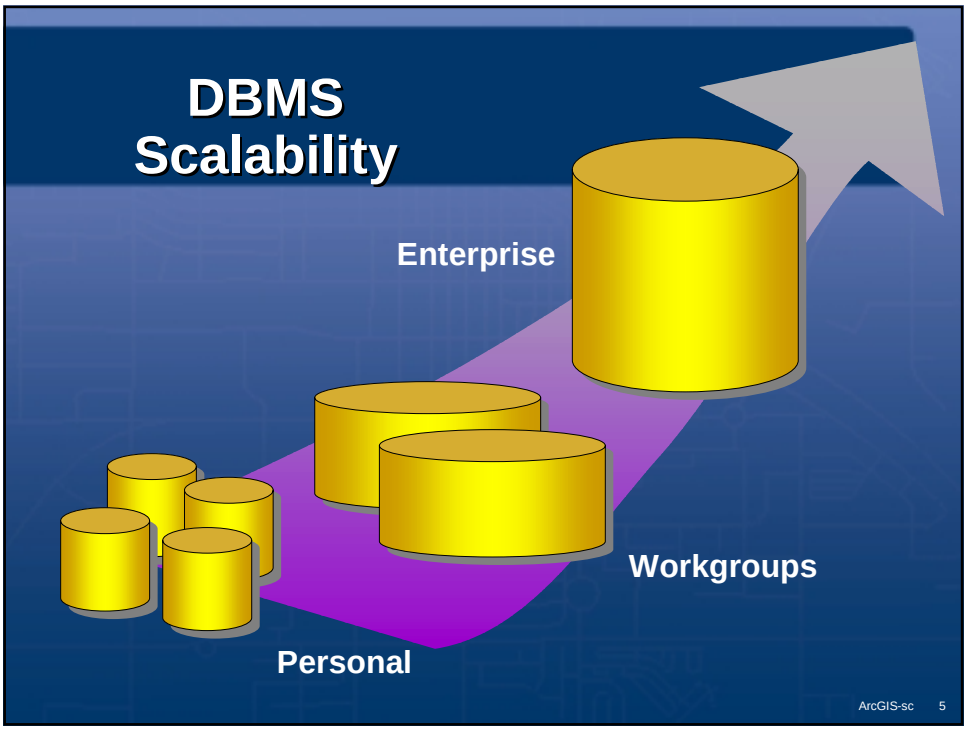
- When God created the earth:
  - After He rested on the 7th day…
  - He created the computer
    - Which was good
  - But He saw the computer was alone
    - Which was not so good
  - So He put the computer into stand-by mode, took from it a RIB, and made from it data
    (RIB: reusable instruction byte)
  - After this, the man and the woman, and all their children for many generations to come flocked to see the data, and the computer was never alone again.

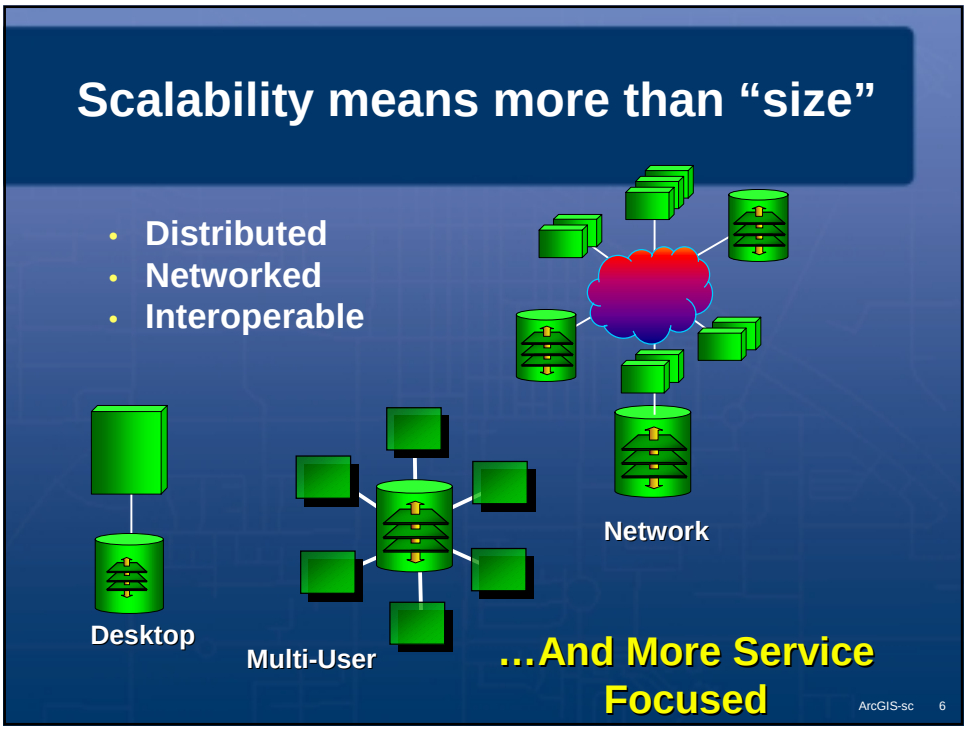
Why a database?

- Organizations need:
  - One file -- not a bunch of files
  - More flexible to use
  - Easier to manage
  - Secure, but accessible
  - Scalable
  - Persists across use and time

Design Goal: To use standard DBMS for spatial data in place of file systems




DBMS
Scalability
Enterprise
Workgroups
Personal
ArcGIS-sc 5


Scalability means more than “size”
Distributed
Networked
Interoperable
Network
Desktop
Multi-User
…And More Service Focused
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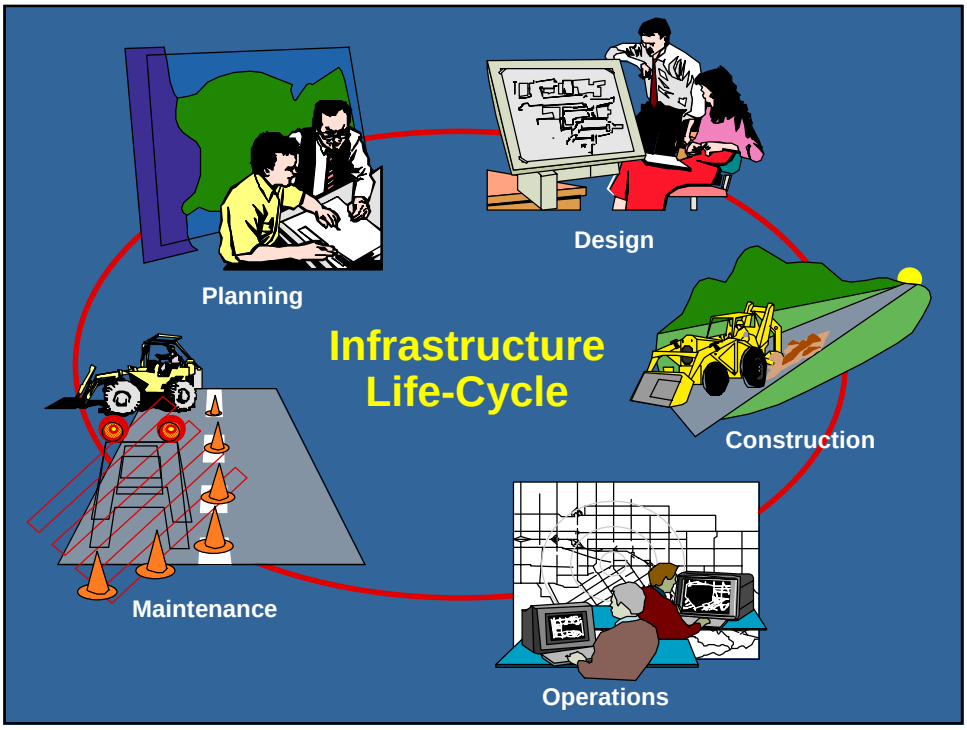
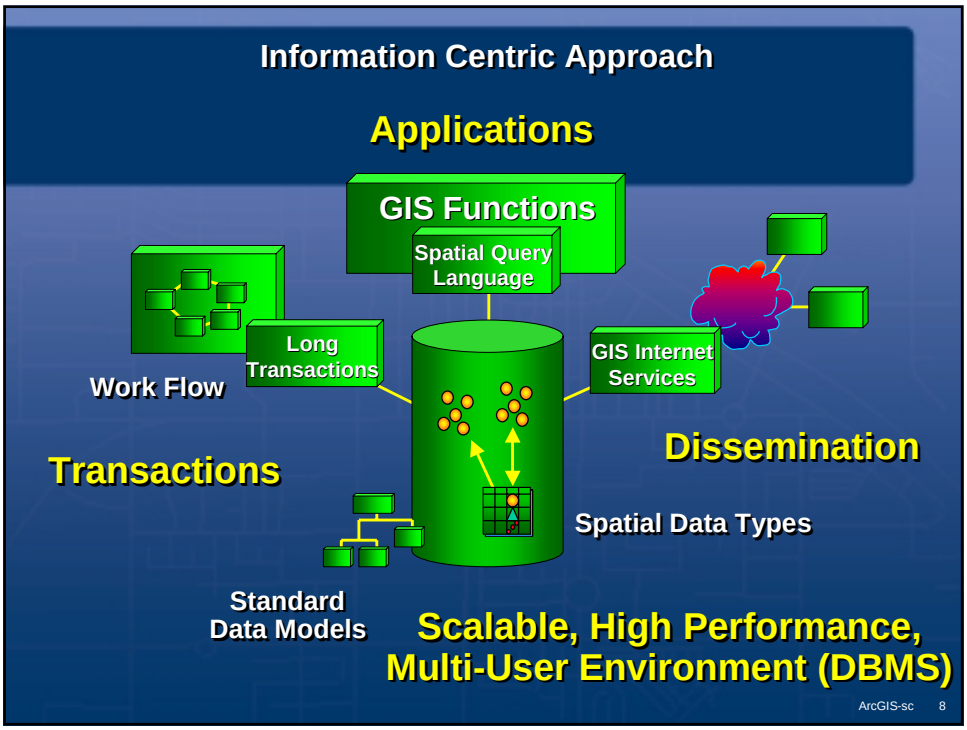

Infrastructure
Life-Cycle
Planning
Design
Construction
Operations
Maintenance


Information Centric Approach
Applications
GIS Functions
Spatial Query Language
Work Flow
Long Transactions
GIS Internet Services
Transactions
Dissemination
Spatial Data Types
Standard Data Models
Scalable, High Performance, Multi-User Environment (DBMS)
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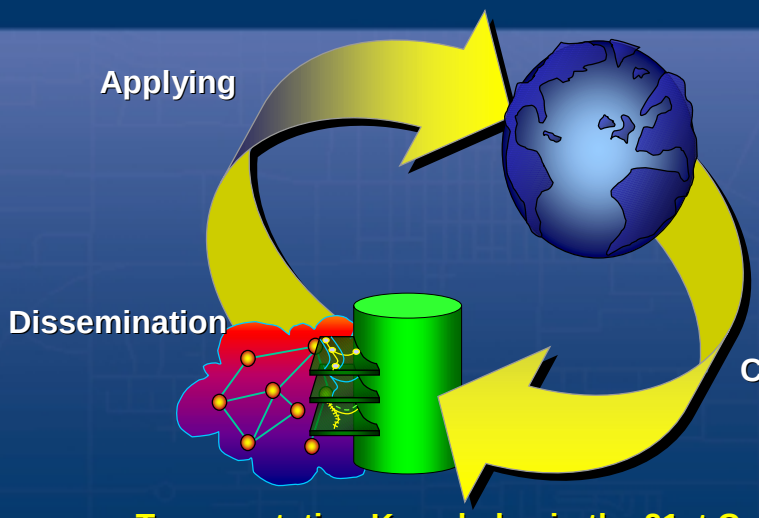
Process-Centric Approach

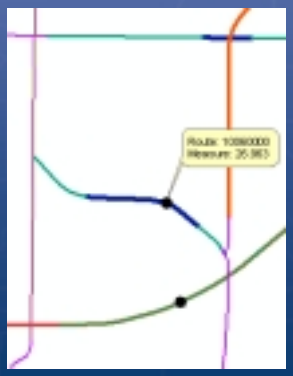
Our Broad Goal: GIS-T Will Be...



Transportation Knowledge in the 21st Century

Goals

- Discuss concepts necessary for migrating and building GIS-T applications in an all relational framework using ArcGIS
- What is the geodatabase?
- Why migrate?
- What about Dynamic Segmentation?



Why store GIS data in an RDBMS

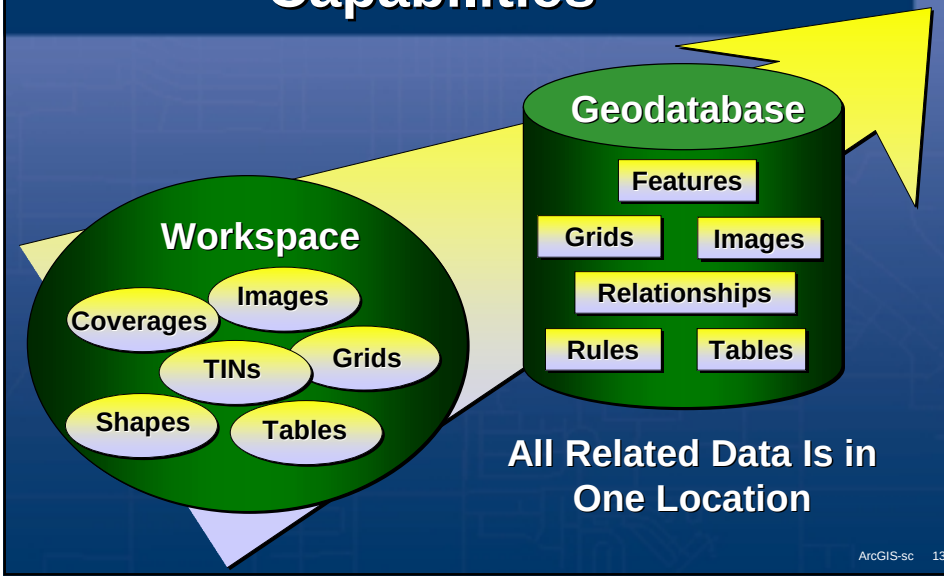
- GIS users want better data management
  - data integrity
  - fast access for many simultaneous users
  - efficient use of the network
  - common environment to manage spatial and tabular data
  - SQL standard

Why store GIS data in an RDBMS

- MIS users want spatial functionality
  - Include spatial data as a managed enterprise asset
  - Support GIS applications
  - Spatially enable applications

    Example:
    - Query to determine bus route and fare
    - Operator types in to/from address
    - Searches for route
    - A rate appears on screen
    - The operator never sees a map

New Data Modeling Capabilities



All Related Data Is in One Location

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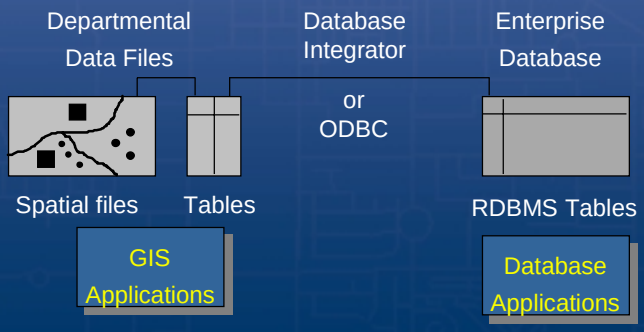
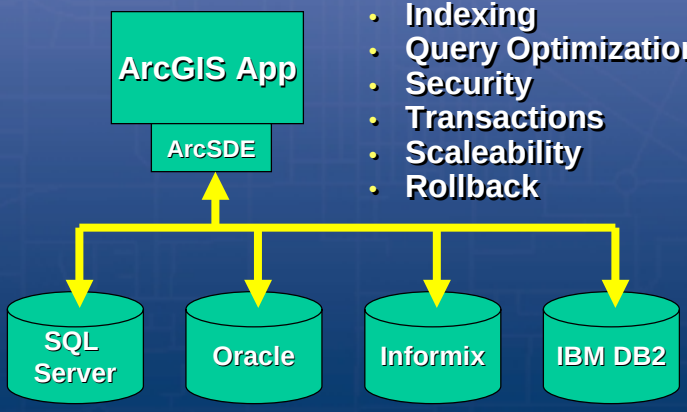
Traditional GIS data is not stored in RDBMS

- Problems coordinating transactions on data
- No referential integrity
- Different application environments



Benefits of an RDBMS for GIS

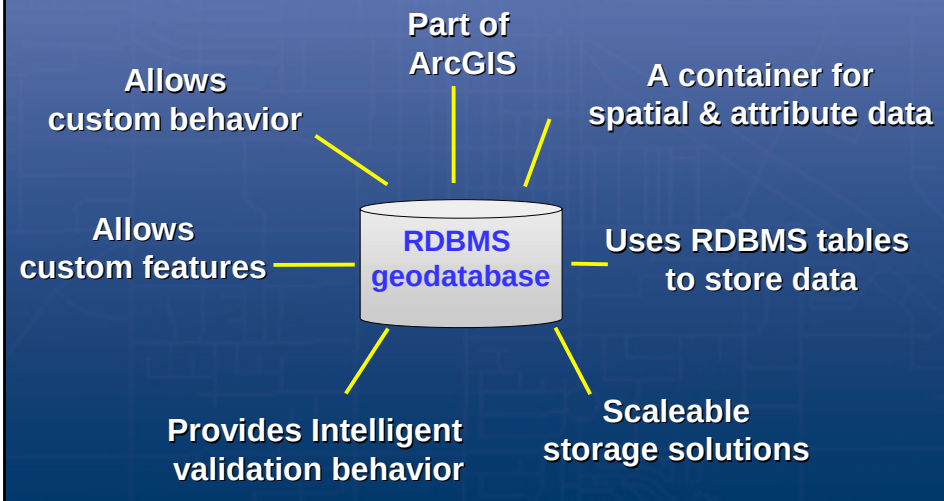


- Corporate Data Centralized
- Indexing
- Query Optimization
- Security
- Transactions
- Scaleability
- Rollback

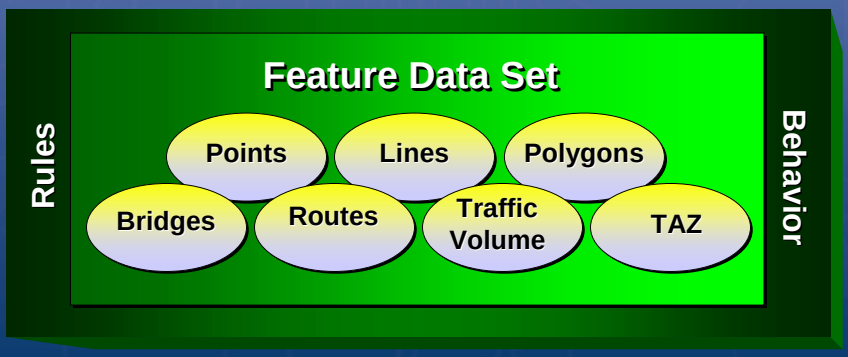
What is the geodatabase

- A new geographic data model
- All relational data storage
- Features with behavior
  - Speed Limit coded value domains
- Topological relationships
  - Geometric Network
- Business Objects
  - Locator, Geoprocessor

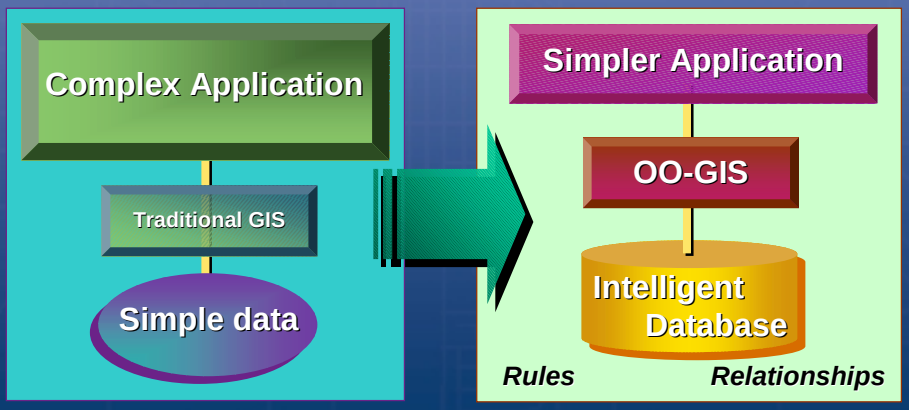
What is the geodatabase



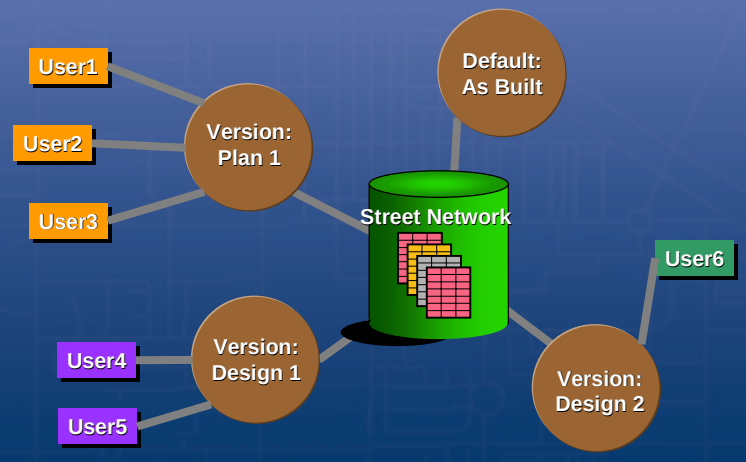
Object Relational: Features as Objects



Intelligent Data Means Less Application Development



A Multi-Versioned Database



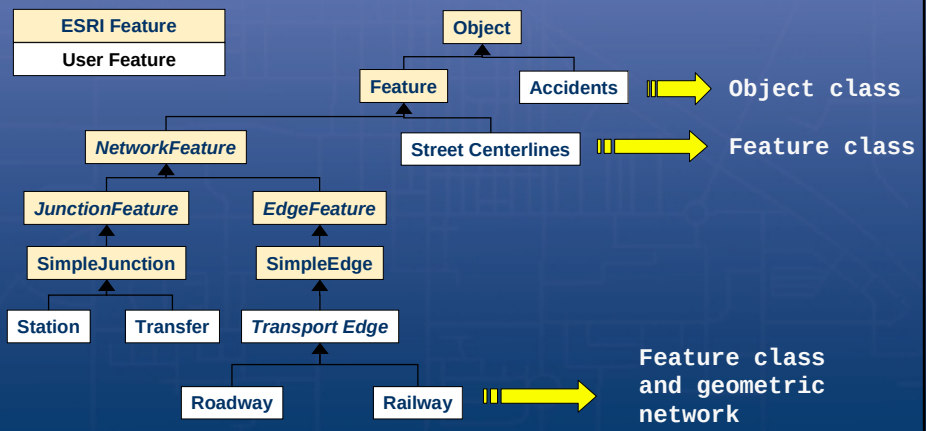
Database Design

- Import spatial, tabular, raster and CAD data *and/or*
- Refine and extend existing classes; define new classes, *or*
- Use CASE and UML for a ground-up redesign of large system

The UML/Case Tools Approach

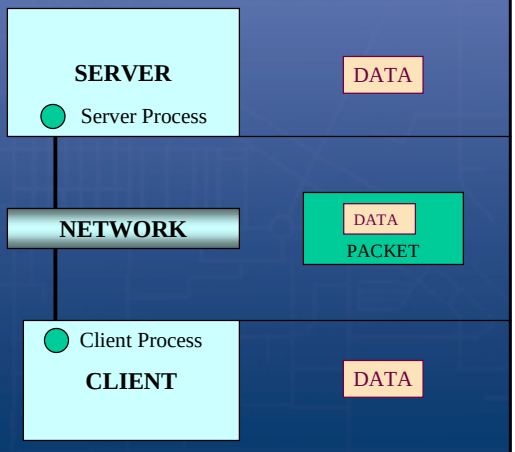
- Use UML to specify
  - Object, feature, and relationship classes
  - class properties, methods, subtypes
  - relationship and connectivity rules
- Use a CASE tool to capture your UML model.

UML Object Model Sample



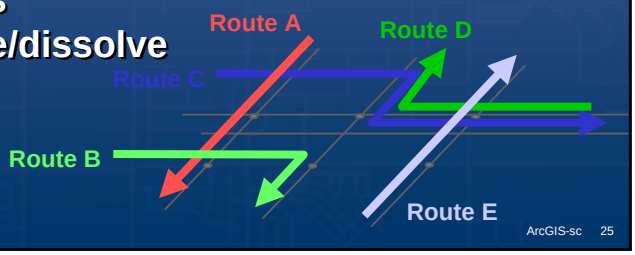
Successfully Implementing a multi-user geodatabase

- How the data is stored in the database
  - Data model
  - Database tuning
- Client Applications
- Client and Server HW configurations

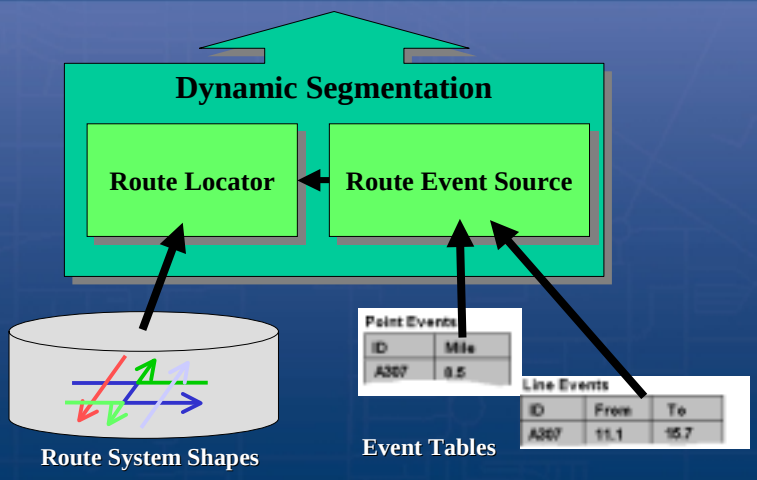


Dynamic Segmentation

- Dynamic Segmentation
  - Render an event table as a dynamic feature layer
  - Interactively find route locations
- Event and Route Updates
- Event Analysis
  - Concatenate/dissolve
  - Overlay



Dynamic Segmentation in a geodatabase

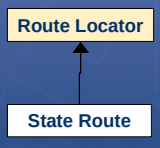


Geodatabase Components for Dynamic Segmentation

- Locators
  - Route Locator
- Route Locations
- Route Events
- Route Event Source
- Event Geoprocessor

What is a Locator?

- A software component that knows how to **transform**:
  - a '**location**' (a spatial description)
    - X,Y coordinates
    - Street Addresses
    - Route Locations
  - into a **known position on a map** (a shape)



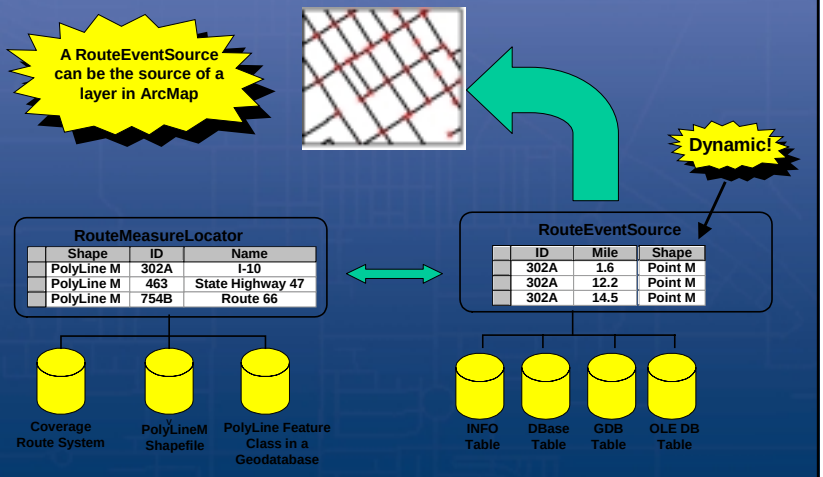
- Combines Reference Data and a Location Method
- A Route Locator is simply one type of Locator
- Route Locators know how to find positions *along* routes (i.e. events) from its origin

Route Events

- A Route Location is
  - a portion or single location along a route
  - located by an identifier (a route) and a measure
- Route Locations stored in a thematic table are known as (route) events

HIGHWAY	LOW	HIGH	PERCENT_CR
17	5.7	6.9	31
17	6.9	7.03	16
16	0	0.3	41
16	0.3	1.1	22
16	1.1	1.3	19
16	1.3	1.5	11

Finding Route Locations



Summary: Why the geodatabase

- Stored in a RDBMS
- Multi-user editing w/ versions and long transactions
- Object oriented geographic data modeling using UML and case tools
- Features with behavior
- Relationships
- Topological relationships
- A set of 'objects' and ' rules' for GIS-T
  - Locators, Event Geoprocessor

Thank-you…any questions?